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PATENT APPLICATION A

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Sir:

Transmitted herewith for filing under 37 CFR 1.53(b) is a(n): (X) Utility ( ) Design
(X) original patent application,
( ) continuation-in-part application

INVENTOR(S): **Eric A Pulsipher et al**

TITLE: **Method For Automatic Layout Of Switched Network Topologies**

Enclosed are:

(X) The Declaration and Power of Attorney. (X) signed ( ) unsigned or partially signed

(X) 12 sheets of drawings (one set) ( ) Associate Power of Attorney

( ) Form PTO-1449 ( ) Information Disclosure Statement and Form PTO-1449

( ) Priority document(s) ( )(Other) _____ (fee $_____)

CLAIMS AS FILED BY OTHER THAN A SMALL ENTITY				
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INDEPENDENT CLAIMS	3 — 3	0	X $78	$ 0
ANY MULTIPLE DEPENDENT CLAIMS	0		$260	$ 0
BASIC FEE: Design $310.00); Utility $690.00)				$ 690
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By Kathy L. Hungsberg

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- Attach as First Page to Transmitted Papers -

METHOD FOR AUTOMATIC LAYOUT OF SWITCHED NETWORK TOPOLOGIES

FIELD OF THE INVENTION

The present invention relates generally to networks and, more particularly, to the management of networks, and, even more particularly, to the topological layout of switched networks.

BACKGROUND OF THE INVENTION

As communications networks, such as the Internet, carry more and more traffic, efficient use of the bandwidth available in the network becomes more and more important. Switching technology was developed in order to reduce congestion and associated competition for the available bandwidth. Switching technology works by restricting traffic. Instead of broadcasting a given data packet to all parts of the network, switches are used to control data flow such that the data packet is sent only along those network segments necessary to deliver it to the target node. The smaller volume of traffic on any given segment results in fewer packet collisions on that segment, and thus the smoother and faster delivery of data. A choice between alternative paths is usually possible and is typically made based upon current traffic patterns.

The intelligent routing of data packets with resultant reduction in network congestion can only be effected if the network topology is known. The topology of a network is a description of the network which includes the location of and interconnections between nodes on the network. The word "topology" refers to either the physical or logical layout of the network, including devices, and their connections in relationship to one another. Information necessary to create the topology layout can be

derived from tables stored in network devices such as hubs, bridges, and switches. The information in these tables is in a constant state of flux as new entries are being added and old entries time out. Many times there simply is not enough information to determine where to place a particular device.

Switches examine each data packet which they receive, read their source addresses, and log those addresses into tables along with the switch ports on which the packets were received. If a packet is received with an unknown target address, the switch receiving it broadcasts that packet to each of its ports. When the switch receives a reply, it will have identified where the new node lies.

In a large network with multiple possible paths from the switch to the target node, this table can become quite large and may require a significant amount of the switch's resources to develop and maintain. As an additional complication, the physical layout of devices and their connections are typically in a state of constant change. Devices are continually being removed from, added to, and moved to new physical locations on the network. To be effectively managed, the topology of a network must be accurately and efficiently ascertained, as well as maintained.

In a switch, each port of the switch forms a so called "collision domain." Existing techniques for ascertaining the topology of a network involve creating a so called "container" or "segment" for each collision domain. Thus, the topological map of the network ends up with one container or segment per port for each switch.

Current methods for creating topological maps in networks containing switches can cause a proliferation of segments. Although such proliferation of segments may be correct under the product's layout models, it causes the network level sub-map to be cluttered and often unusable. As an example, a port on a switch connected to a node would create a new segment on the topological map, as would the attachment of a port on a switch to a port on another switch. For a network comprising a large number of switches and nodes the number of segments and associated table entries can quickly become very large and unwieldy resulting in the heavy use of computer resources in creating and maintaining network topological data. Thus, there exists a need for a method of creating a topological map of a network which is accurate, frugal in its

utilization of network resources, and which can easily be used to update the network map as changes occur.

SUMMARY OF THE INVENTION

The present patent document relates to a novel method for intelligently and automatically laying out the topologies of switched networks. Previous methods for laying out the topologies of switched networks have relied upon creating a segment for each and every switch port connected to a node and upon creating a segment for each port of a switch that is connected to a port of another switch.

As used herein, a node is any electronic device or combination of electronic devices with their interconnections. In the representative embodiments disclosed, the nodes could be for example combinations of interconnected electronic devices, such as but not limited to other networks and sub-networks. Also, the nodes could be terminals, workstations, personal computers, printers, scanners, or any other electronic device which can be connected to networks.

Also as used herein, a switching device is any device that controls the flow of messages on a network. Switching devices include, but are not limited to, any of the following devices: repeaters, hubs, routers, bridges, and switches.

In representative embodiments, bus segments are disclosed wherein a bus segment comprises two or more nodes connected to a port of a switching device, serial segments are disclosed wherein a serial segment comprises a port on one switching device connected to a port on another switching device, and star segments are disclosed wherein a star segment comprises all ports with attached nodes on a switching device that have only one node connected to each port.

A primary advantage of the embodiment as described in the present patent document over prior techniques is the reduction in the number of segments created in topological maps of the network with a resultant simplification of the topology maps for networks. It is recognized that the topological mapping referred to herein may be contained in one or more tables, and it is not necessarily required for the mapping system to create the map as a drawing. The simplifications provided in the representative embodiments of the present application provide further advantage in reducing the consumption of valuable system resources.

Other aspects and advantages of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings provide visual representations which will be used to more fully describe the invention and can be used by those skilled in the art to better understand it and its inherent advantages. In these drawings, like reference numerals identify corresponding elements and:

Figure 1 is a drawing of a typical topological bus segment for representing the connectivity of nodes on a network as described in various representative embodiments of the present patent document.

Figure 2 is a drawing of a typical topological serial segment for representing the connectivity of nodes on the network as described in various representative embodiments of the present patent document.

Figure 3 is a drawing of a typical topological star segment for representing the connectivity of nodes on the network as described in various representative embodiments of the present patent document.

Figure 4 is a drawing of another typical topological star segment for representing the connectivity of nodes on the network as described in various representative embodiments of the present patent document.

Figure 5 is a drawing of the connectivity of an example network system.

Figure 6 is a drawing of the connectivity of the example network system of figure 5 illustrating the location of typical segments.

Figure 7 is a drawing of a reduced segment topological map of the example network system of figure 5 as described in various representative embodiments of the present patent document.

Figure 8 is a flow chart of the method steps performed in creating reduced segment topological maps as described in various representative embodiments of the present patent document.

Figure 9A is a flow chart of a portion of the method steps of figure 8 performed in creating the reduced segment topological map as described in various representative embodiments of the present patent document.

Figure 9B is a flow chart of a continuation of a part of the flow chart of figure 9A as described in various representative embodiments of the present patent document.

Figure 9C is a flow chart of a continuation of another part of the flow chart of figure 9A as described in various representative embodiments of the present patent document.

Figure 10 is a drawing of a computer used for creating and managing reduced segment topological maps for representing the connectivity of nodes on the network as described in various representative embodiments of the present patent document.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in the drawings for purposes of illustration, the present patent document relates to a novel method for intelligently and automatically laying out the topologies of switched networks. Previous methods for laying out the topologies of switched networks have relied upon creating a segment for each and every switch port connected to a node and upon creating a segment for each port of a switch that is connected to a port of another switch. In the following detailed description and in the several figures of the drawings, like elements are identified with like reference numerals.

1. Definitions:

As used herein, a node is any electronic device or combination of electronic devices with their interconnections.

A switching device is any device that controls the flow of messages on a network. Switching devices include, but are not limited to, any of the following devices: repeaters, hubs, routers, bridges, and switches.

Figure 1 is a drawing of a typical topological bus segment **100** for representing the connectivity of nodes on a network **110** as described in various representative embodiments of the present patent document. In figure 1, a first and second nodes **121,122**, as well as a first port **131** of a first switching device **140** are interconnected via the network **110**. The bus segment **100** comprises the first and second nodes **121,122** connected to the first port **131** of the first switching device **140**. Nodes heard on a common port of a switch are placed into a bus segment.

Figure 2 is a drawing of a typical topological serial segment **200** for representing the connectivity of nodes on the network **110** as described in various representative embodiments of the present patent document. In figure 2, the first node **121** comprises a second port **132** on a second switching device **145** which is connected via the network **110** to the first port **131** on the first switching device **140**. The serial segment **200** comprises the second port **132** on the second switching device **145** connected to the first port **131** on the first switching device **140**.

Figure 3 is a drawing of a typical topological star segment **300** for representing the connectivity of nodes on the network **110** as described in various representative embodiments of the present patent document. In figure 3, the first node **121** is connected to the first port **131** of the first switching device **140**. The star segment **300** comprises the first node **121** connected to the first port **131** of the first switching device **140**.

Figure 4 is a drawing of another typical topological star segment **300** for representing the connectivity of nodes on the network **110** as described in various representative embodiments of the present patent document. In addition to the connections described with respect to figure 3, a third node **123** is connected to a third port **133** of the first switching device **140** and a fourth node **124** is connected to a fourth port **134** of the first switching device **140**. In figure 4, the star segment **300** comprises the first node **121** connected to the first port **131** of the first switching device **140**, the third node **123** connected to the third port **133** of the first switching device **140**, and the fourth node **124** connected to the fourth port **134** of the first switching device **140**. Thus, the star segment **300** comprises, on a given switching device, at least one port, wherein one and only one node is connected to that port, and that node. In the more general case, the star segment **300** comprises, on a given switching device, all ports having one and only one node connected to each port, and those connected nodes. Since the segments drawn using the topological methods of figure 4 resemble a star, they are referred to as star segments.

For illustrative purposes, nodes in the figures described above and in subsequent figures are shown as individual electronic devices or ports on switching devices. However, in other representative embodiments the nodes could be, for example, combinations of interconnected electronic devices, such as but not limited to other networks and sub-networks. Also, in the figures the nodes are represented as terminals. However, they could also be workstations, personal computers, printers, scanners, or any other electronic device which can be connected to networks **110**.

2. Example Network Connectivity

Figure 5 is a drawing of the connectivity of an example network system. In figure

5, first, third, and fourth nodes **121,123,124** are connected via the network **110** to first, third, and fourth ports **131,133,134** respectively, wherein the first, third, and fourth ports **131,133,134** are located on the first switching device **140**. Also in figure 5, fifth, sixth, and seventh nodes **125,126,127** are connected via the network **110** to fifth, sixth, and seventh ports **135,136,137** respectively and an eight node **128** is connected via the network **110** to the seventh port **137**, wherein the fifth, sixth, and seventh ports **135,136,137** are located on the second switching device **145**. The first switching device **140** is connected to the second switching device **145** via an eight port **138** located on the first switching device **140** and via a ninth port **139** located on the second switching device **145** with the eight port **138** and the ninth port **139** also being connected to the network **110**.

Figure 6 is a drawing of the connectivity of the example network system of figure 5 illustrating the location of typical segments. This figure illustrates the proliferation of segments which can occur when segments are indiscriminately assigned. In figure 6, a first, third, and fourth segments **621,623,624** represent respectively the connectivity of the first, third, and fourth nodes **121,123,124** via the network **110** with the first, third, and fourth ports **131,133,134** on the first switching device **140**. Fifth and sixth segments **625,626** represent respectively the connectivity of the fifth and sixth nodes **125,126** via the network **110** with the fifth and sixth ports **135,136** on the second switching device **145**. In addition, a seventh segment **627** represents the connectivity of seventh and eighth nodes **127,128** via the network **110** with the seventh port **137** on the second switching device **145**. An eighth segment **628** represents the connectivity of the eighth port **138** on the first switching device **140** via the network **110** with the ninth port **139** on the second switching device **145**. Creating topological maps of the network **110** as shown in figure 6 results in a topological segment for every node/switch port pair on the network **110**. In complex networks the proliferation of segments which will change as nodes are added to and removed from the network rapidly becomes unmanageable. Thus, there exists a need for a method of creating a topological map of a network which is accurate, frugal in its utilization of network resources, and which can easily be used to update the network map as changes occur. Considerable simplification in the topological map of figure 6 can

be obtained by replacing the numerous segments in figure 6 with bus, serial, and star segments similar to those of figures 1-4.

Figure 7 is a drawing of a reduced segment topological map **700** of the example network system of figure 5 as described in various representative embodiments of the present patent document. In figure 7, first, third, and fourth segments **621,623,624** of figure 6 are replaced by a first star segment **731**; the eighth segment **628** of figure 6 is replaced by a first serial segment **721**; fifth and sixth segments **625,626** of figure 6 are replaced by a second star segment **732**; and seventh segment **627** of figure 6 is replaced by a first bus segment **711**. The bus, serial, and star segments of figure 7 are similar to those of figures 1-4. Once again note the simplification that is obtained. The seven segments of figure 6 have been reduced to four in figure 7. For purposes of clarity in representative embodiments, the various segments of figure 7 would typically be shown interconnected via ports on switches even though the ports on those switches are parts of the segments themselves.

Figure 8 is a flow chart of the method steps performed in creating reduced segment topological maps **700** as described in various representative embodiments of the present patent document.

When there are remaining un-selected switching devices on the network **110**, block **810** transfers control to block **820**. Otherwise, block **810** terminates the process.

Block **820** selects a previously un-selected switching device and then transfers control to block **830**.

When there are remaining un-selected ports on the selected switching device, block **830** transfers control to block **840**. Otherwise, block **830** transfers control to block **810**.

Block **840** selects a previously un-selected port on the selected switching device and then transfers control to block **850**.

Block **850** maps the connection of the electronic device, i.e. the node, connected to the selected port on the selected switching device. Block **850** then transfers control to block **830**.

In summary, in representative embodiments reduced segment topological maps

700 are created by combining all switching devices connected to the network with all nodes that are connected to the ports of each switching device. The methods presented may be implemented in a computer program readable by a computer. The computer may be connected to the network.

Figure 9A is flow chart of a portion of the method steps of figure 8 performed in creating the reduced segment topological map **700** as described in various representative embodiments of the present patent document. In particular, figure 9A, with related figures 9B and 9C, form an expansion of Block **850** of figure 8. When node has been detected by switching device **140,145** on the network **110**, block **905** transfers control to block **910**. Otherwise, block **905** transfers control to block **830** of figure 8.

When other nodes have been detected on the same port by the switching device **140** block **910** transfers control to block **950**, otherwise block **910** transfers control to block **915**. Block **915** is shown on figure 9B, and block **950** is shown in figure 9C. The connection between blocks **910** and **915** is shown as (A) in figures 9A and 9B, and the connection between blocks **910** and **950** is shown as (B) in figures 9A and 9C.

Figure 9B is a flow chart of a continuation of a part of the flow chart of figure 9A as described in various representative embodiments of the present patent document. When the detected address belongs to another connector device block **915** transfers control to block **920**, otherwise block **915** transfers control to block **935**.

When serial segment **200** exists on this port of the switching device **140,145**, block **920** transfers control to block **930**, otherwise block **920** transfers control to block **925**.

Block **925** creates serial segment **200** and then transfers control to block **930**.

Block **930** moves the node to the serial segment **200**. Block **930** then transfers control to block **830** of figure 8.

When a star segment exist on this port of the connector device, block **935** transfers control to block **945**, otherwise block **935** transfers control to block **940**.

Block **940** creates star segment **300** and then transfers control to block **945**.

Block **945** moves the node to the star segment **300**. Block **945** then transfers control to block **830** of figure 8.

Figure 9C is a flow chart of a continuation of another part of the flow chart of figure 9A as described in various representative embodiments of the present patent document. When bus segment **100** exists on this port of the switching device **140,145**, block **950** transfers control to block **960**, otherwise block **950** transfers control to block **955**.

Block **955** creates bus segment **100**. Block **955** then transfers control to block **960**.

When serial segment **200** exists on this port of the connector device, block **960** transfers control to block **965**, otherwise block **960** transfers control to block **970**.

Block **965** moves the contents of the serial segment **200** to the bus segment **100** and deletes the serial segment **200**. Block **965** then transfers control to block **970**.

Block **970** moves the detected node to the bus segment **100**. Block **970** then transfers control to block **975**.

When the detected node is in existing star segment **300** for the switching device **140,145**, block **975** transfers control to block **980**, otherwise block **975** transfers control to block **830** of figure 8.

When the star segment **300** is empty, block **980** transfers control to block **985**, otherwise block **980** transfers control to block **830** of figure 8.

Block **985** deletes the star segment **300**. Block **985** then transfers control to block **830** of figure 8.

Figure 10 is a drawing of a computer **1000** used for creating and managing reduced segment topological maps **700** for representing the connectivity of nodes **121-127** on the network **110** as described in various representative embodiments of the present patent document. In figure 10, a software program **1020** comprising the method steps of figures 8, 9A, 9B, and 9C is stored on a program storage medium **1010** which could be, for example, a floppy disk, a CD ROM, a hard disk, RAM, or ROM. The memory represented by the program storage medium **1010** could be the main memory of the computer, a cache, or could be maintained remotely. The computer **1000** runs the software program **1020** in order to create and manage the reduced segment topological maps **700**.

3. Concluding Remarks

A primary advantage of the embodiment as described in the present patent document over prior techniques is the reduction in the number of segments created in topological maps of the network. The technique of figure 6 creates a total of seven segments for the network of figure 5, while representative embodiments of the present invention create four segments for the same network as shown in figure 7. There is a resultant simplification of the topology of the example network. It is recognized that the topological mapping referred to herein may be contained in one or more tables, and it is not necessarily required for the mapping system to create the map as a drawing. The simplifications provided in the representative embodiments of the present application provide further advantage in reducing the consumption of valuable system resources.

While the present invention has been described in detail in relation to preferred embodiments thereof, the described embodiments have been presented by way of example and not by way of limitation. It will be understood by those skilled in the art that various changes may be made in the form and details of the described embodiments resulting in equivalent embodiments that remain within the scope of the appended claims.

CLAIMS

What is claimed is:

1. A program storage medium readable by a computer, tangibly embodying a software program executable by the computer to perform method steps for specifying a topological map, wherein the topological map describes the connectivity of nodes on a network, said steps comprising:

when a first node is detected on a first port of a first switching device, wherein both the first node and the first switching device are connected to the network:

when a second node was previously detected on the first port, specifying the topology of a bus segment, wherein the bus segment comprises the first node, the second node, and the first port interconnected via the bus structure;

otherwise, when the first node is a second port located on a second switching device, specifying the topology of a serial segment, wherein the serial segment comprises the second port connected to the first port;

otherwise, specifying the topology of a star segment, wherein the star segment comprises the first node connected to the first port.

2. The program storage medium as recited in claim 1, wherein first and second nodes are electronic devices.

3. The program storage medium as recited in claim 1, wherein first and

second switching devices are electronic devices selected from the group consisting of repeaters, hubs, routers, bridges, and switches.

4. The program storage medium as recited in claim 1, wherein the star segment further comprises a third node connected to a third port located on the first switching device.

5. The program storage medium as recited in claim 1, wherein the method step specifying the topology of the bus segment comprises:

when the bus segment is absent, creating the bus segment;

when the serial segment exists:

transferring the second node and the first port to the bus segment; and

deleting the serial segment;

transferring the first node to the bus segment;

when previously created star segment comprises the first node prior to transferring the first node to the bus segment and when the previously created star segment is empty after transferring the first node to the bus segment, deleting the previously created star segment.

6. The program storage medium as recited in claim 1, wherein the method step specifying the topology of the serial segment comprises:

when the serial segment is absent, creating the serial segment, transferring

the first node to the serial segment.

7. The program storage medium as recited in claim 1, wherein the method step specifying the topology of the star segment comprises:

when the star segment is absent, creating the star segment, transferring the first node to the star segment.

8. A computer operable method for specifying a topological map, wherein the topological map describes the connectivity of nodes on a network, comprising the steps of:

when a first node is detected on a first port of a first switching device, wherein both the first node and the first switching device are connected to a network:

when a second node was previously detected on the first port, specifying the topology of a bus segment, wherein the bus segment comprises the first node, the second node, and the first port interconnected via the bus structure;

otherwise, when the first node is a second port located on a second switching device, specifying the topology of a serial segment, wherein the serial segment comprises the second port connected to the first port;

otherwise, specifying the topology of a star segment, wherein the star segment comprises the first node connected to the first port.

9. The computer operable method as recited in claim 8, providing first and

second nodes are electronic devices.

10. The computer operable method as recited in claim 8, providing first and second switching devices are electronic devices selected from the group consisting of repeaters, hubs, routers, bridges, and switches.

11. The computer operable method as recited in claim 8, providing the star segment further comprises a third node connected to a third port located on the first switching device.

12. The computer operable method as recited in claim 8, the method step specifying the topology of the bus segment comprising:

when the bus segment is absent, creating the bus segment:

when the serial segment exists:

transferring the second node and the first port to the bus segment; and

deleting the serial segment;

transferring the first node to the bus segment;

when previously created star segment comprises the first node prior to transferring the first node to the bus segment and when the previously created star segment is empty after transferring the first node to the bus segment, deleting the previously created star segment.

13. The computer operable method as recited in claim 8, the method step

specifying the topology of the serial segment comprising:

when the serial segment is absent, creating the serial segment, transferring the first node to the serial segment.

14. The computer operable method as recited in claim 8, the method step specifying the topology of the star segment comprising:

when the star segment is absent, creating the star segment, transferring the first node to the star segment.

15. A topological map for describing the connectivity of nodes on a network, comprising:

at least one map segment, wherein the map segment is,

when a first node and a second node are both connected to a first port on a first switching device, a bus segment wherein the bus segment comprises a map representation of the first node, the second node, and the first port connected via the bus structure; and

otherwise, when the first port on the first switching device is connected to a second port on a second switching device, a serial segment, wherein the serial segment comprises the map representation of the first port connected to the second port;

otherwise, when the first node is connected to the first port on the first switching device, a star segment, wherein the star segment comprises the map representation of the first node connected to

the first port.

16. The topological map as recited in claim 15, wherein first and second nodes are electronic devices.

17. The topological map as recited in claim 15, wherein first and second switching devices are electronic devices selected from the group consisting of repeaters, hubs, routers, bridges, and switches.

18. The topological map as recited in claim 15, wherein the star segment further comprises a third node connected to a third port located on the first switching device.

ABSTRACT

A method for the automatic layout of switched networks of switched network topologies. In representative embodiments, the present patent document discloses methods for intelligently and automatically laying out the topologies of switched networks. Previous methods for laying out the topologies of switched networks have relied upon creating a segment for each and every switch port connected to a node and upon creating a segment for each port of a switching device that is connected to a port of another switching device. In complex networks the proliferation of segments which will change as nodes are added to and removed from the network rapidly becomes unmanageable. Considerable simplification of the topological map can be obtained by combining various segments into one of three segment types, a bus segment, a serial segment, and a star segment, disclosed in the present document. In the creation of the topological map of network, the disclosed methods are frugal in their utilization of network resources and can easily be used to update the network map as changes occur.

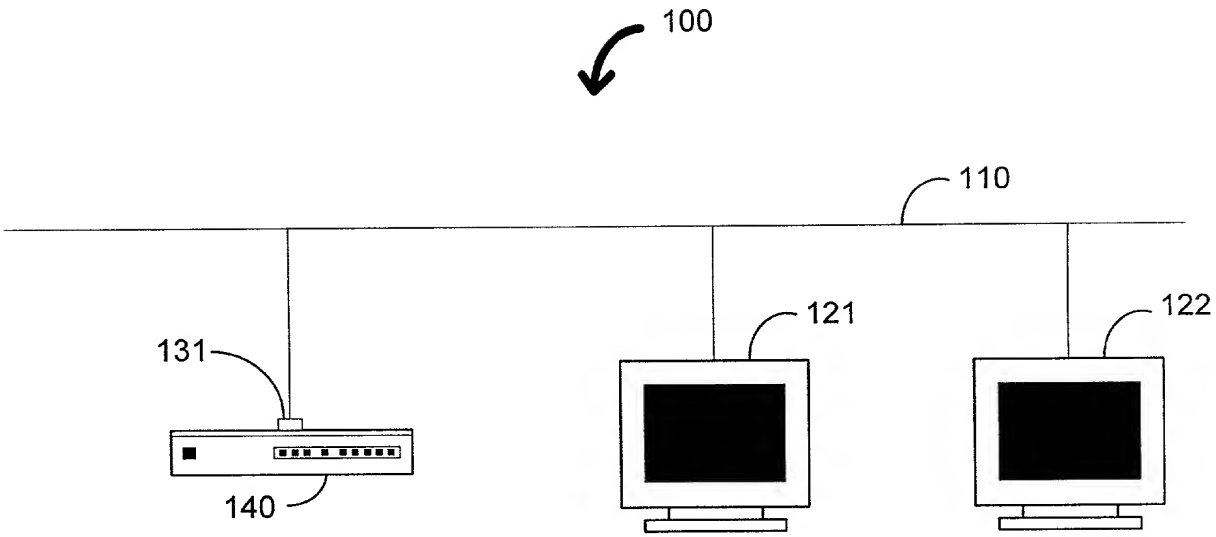

FIG. 1

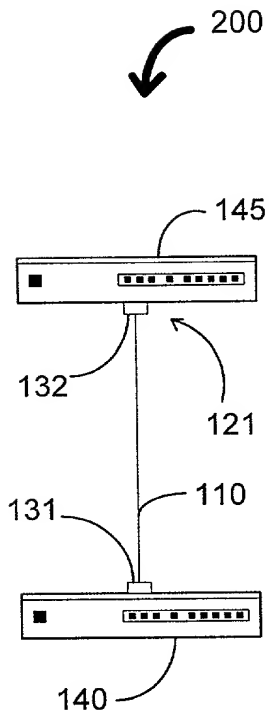

FIG. 2

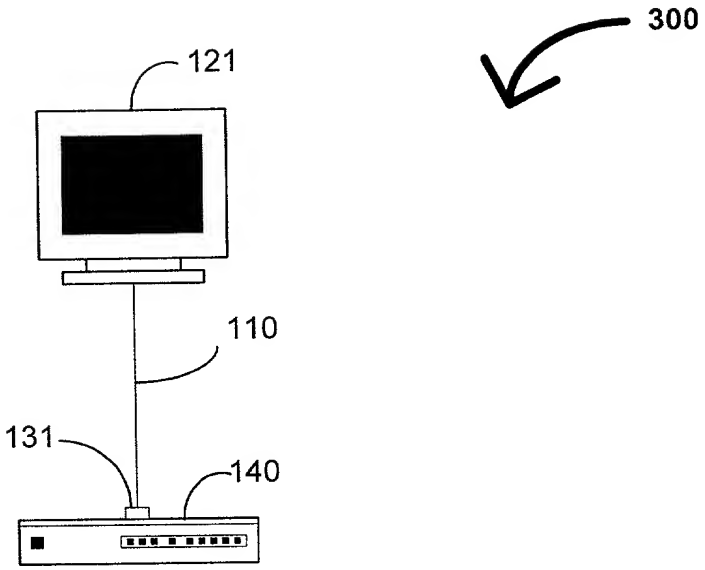

FIG. 3

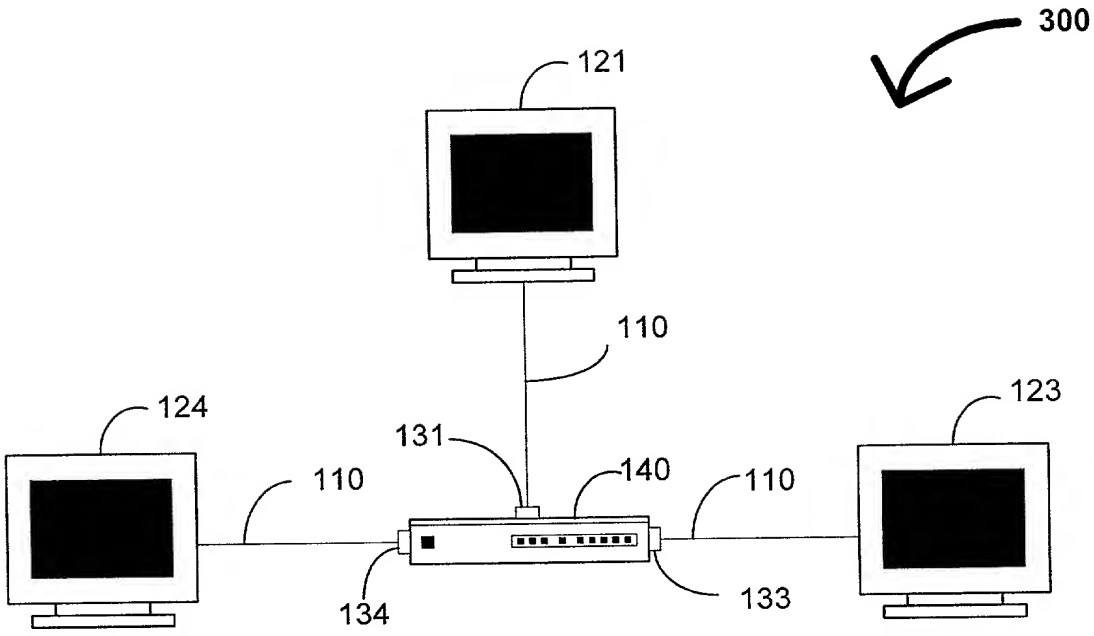

FIG. 4

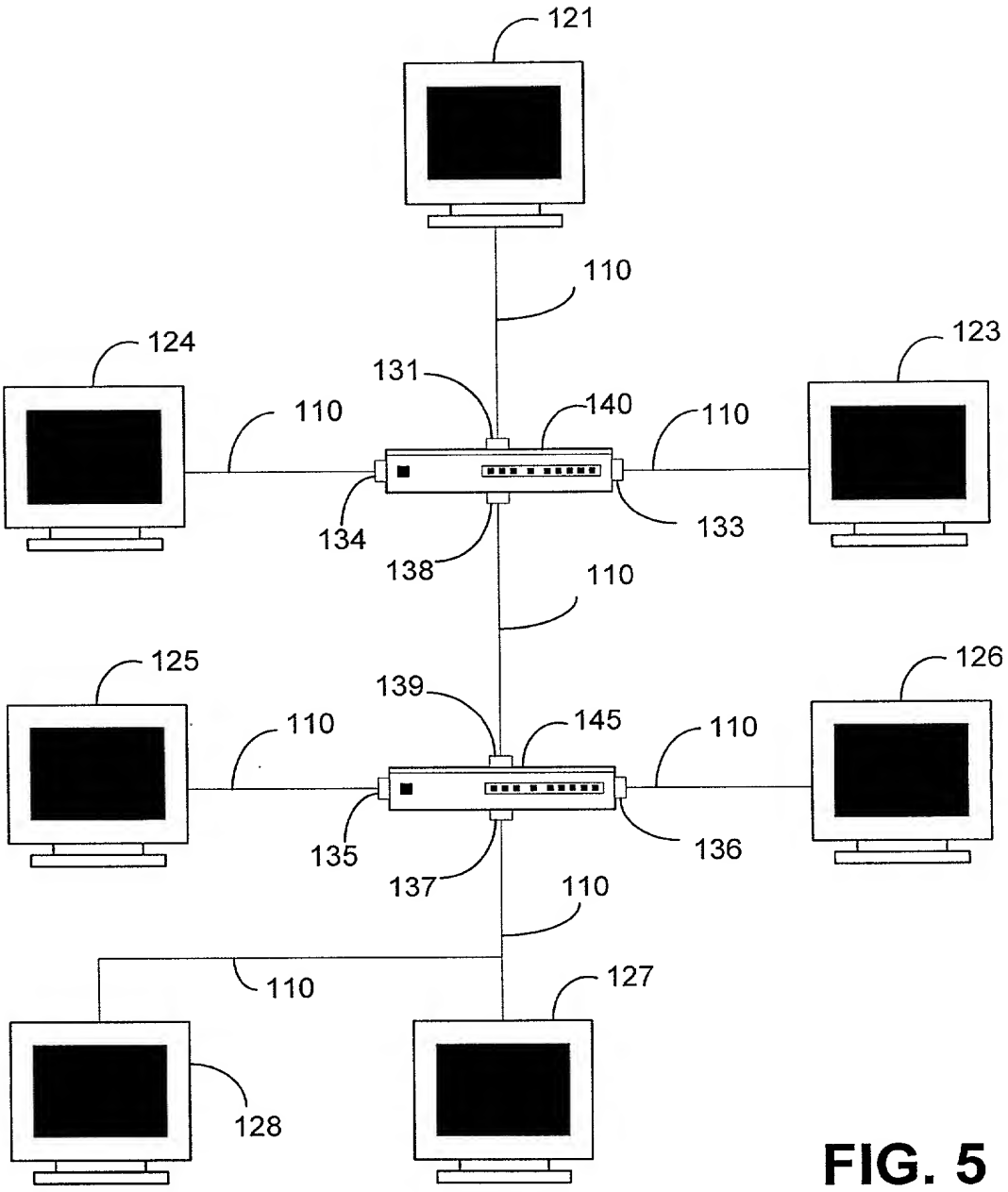

FIG. 5

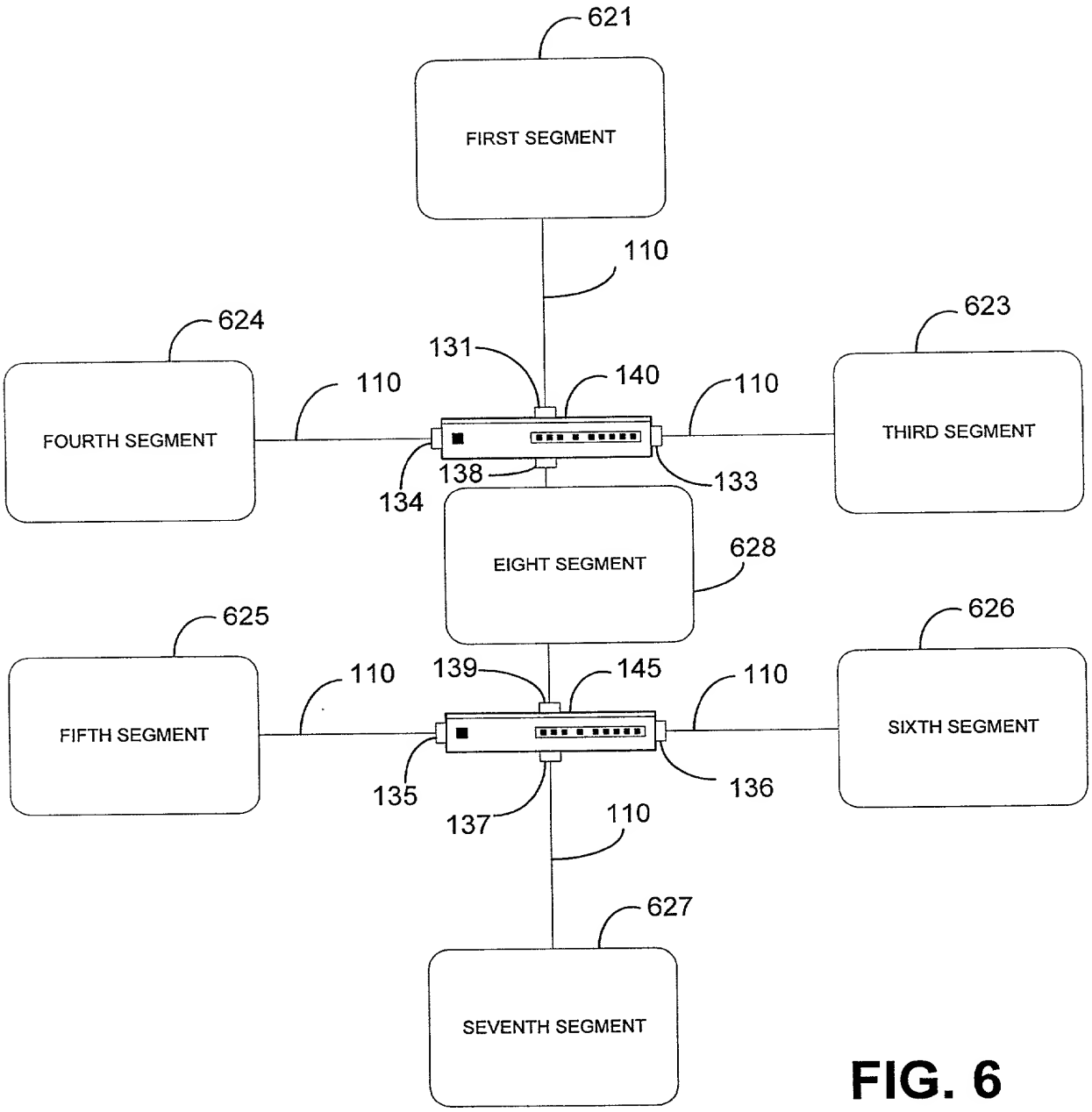
621
FIRST SEGMENT
110
624
FOURTH SEGMENT
131
140
110
110
623
THIRD SEGMENT
134
138
133
EIGHT SEGMENT
628
625
FIFTH SEGMENT
139
145
110
110
626
SIXTH SEGMENT
135
137
136
110
627
SEVENTH SEGMENT

FIG. 6

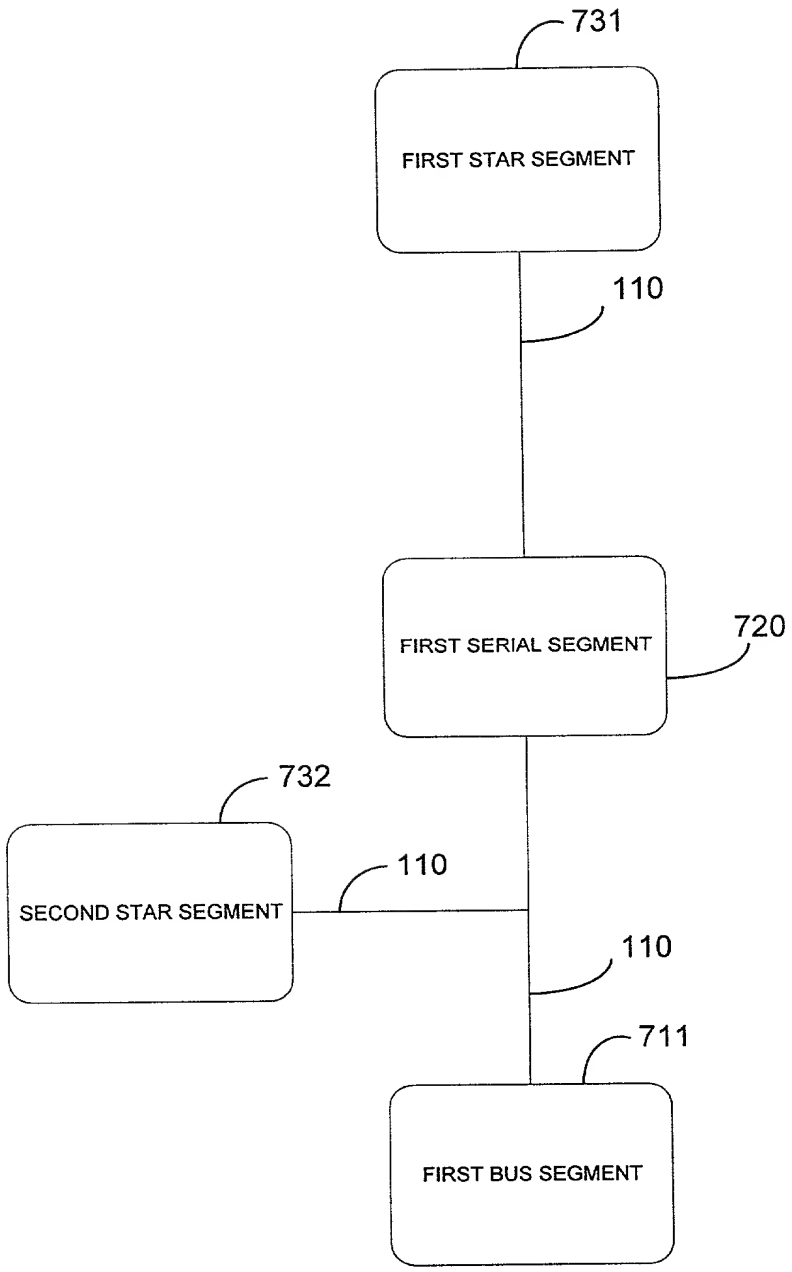
731
FIRST STAR SEGMENT
700
110
FIRST SERIAL SEGMENT
720
732
SECOND STAR SEGMENT
110
110
711
FIRST BUS SEGMENT

FIG. 7

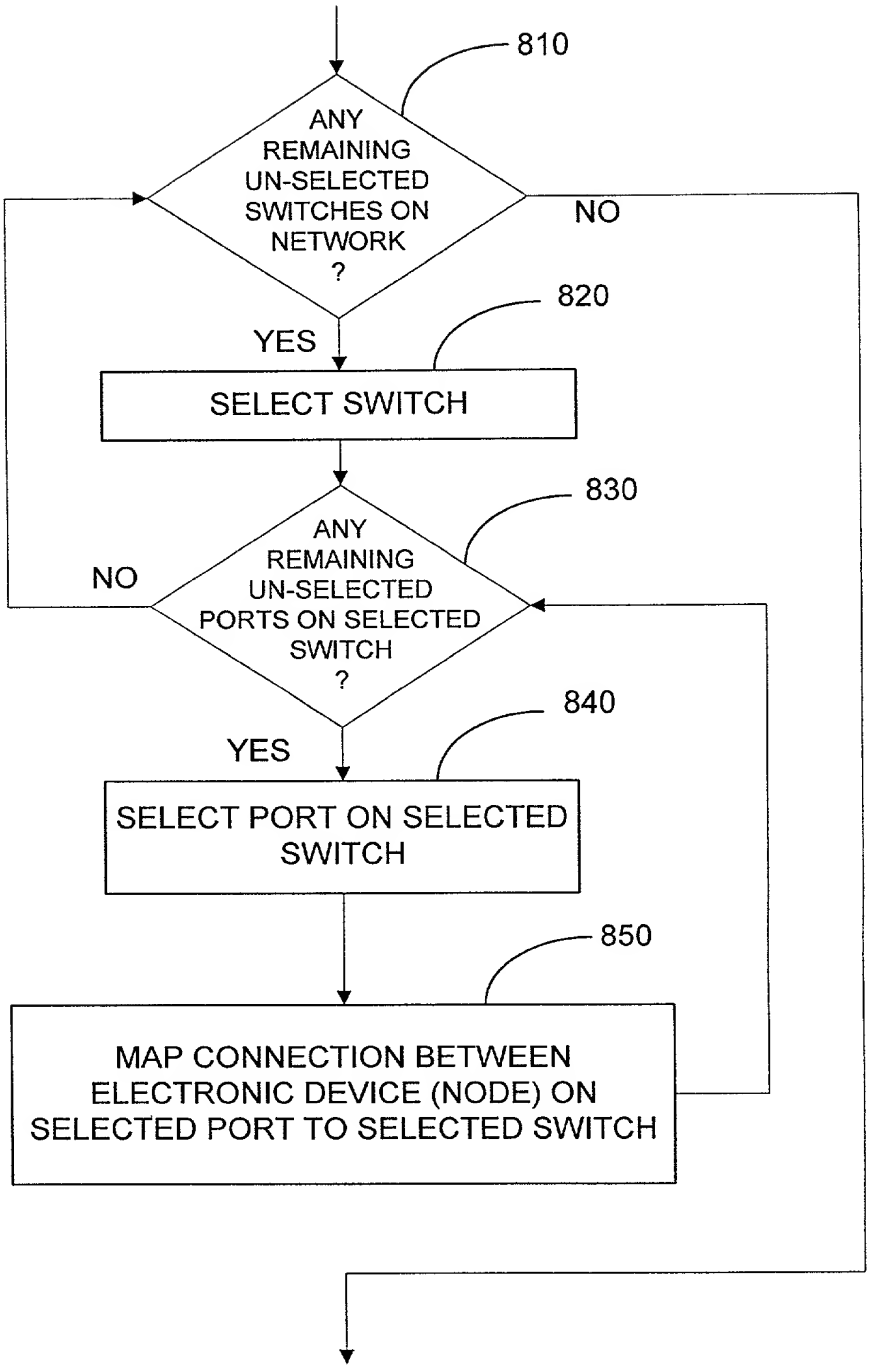
810
ANY REMAINING UN-SELECTED SWITCHES ON NETWORK ?
NO
YES
820
SELECT SWITCH
830
ANY REMAINING UN-SELECTED PORTS ON SELECTED SWITCH ?
NO
YES
840
SELECT PORT ON SELECTED SWITCH
850
MAP CONNECTION BETWEEN ELECTRONIC DEVICE (NODE) ON SELECTED PORT TO SELECTED SWITCH

FIG. 8

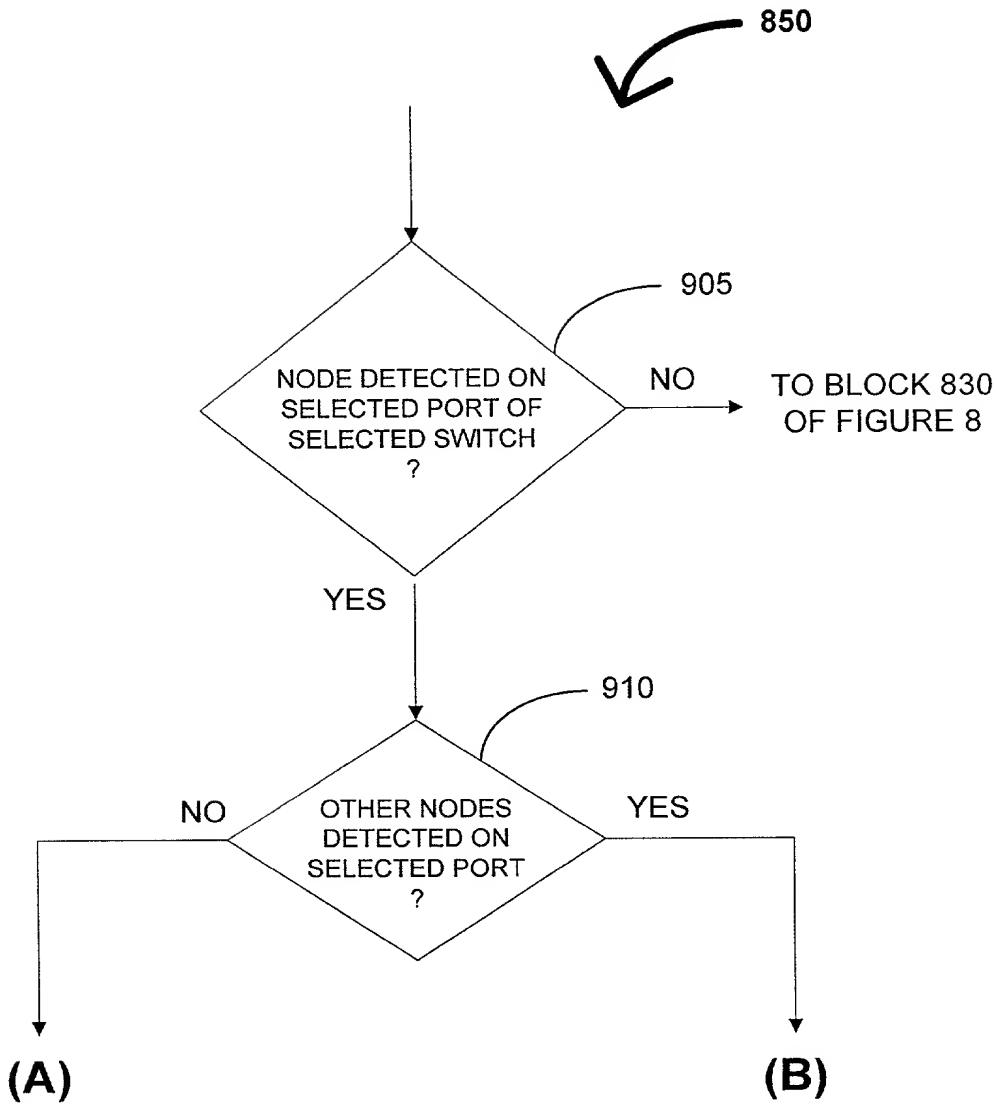
850
905
NODE DETECTED ON SELECTED PORT OF SELECTED SWITCH ?
NO
TO BLOCK 830 OF FIGURE 8
YES
910
OTHER NODES DETECTED ON SELECTED PORT ?
NO
YES
(A)
(B)

FIG. 9A

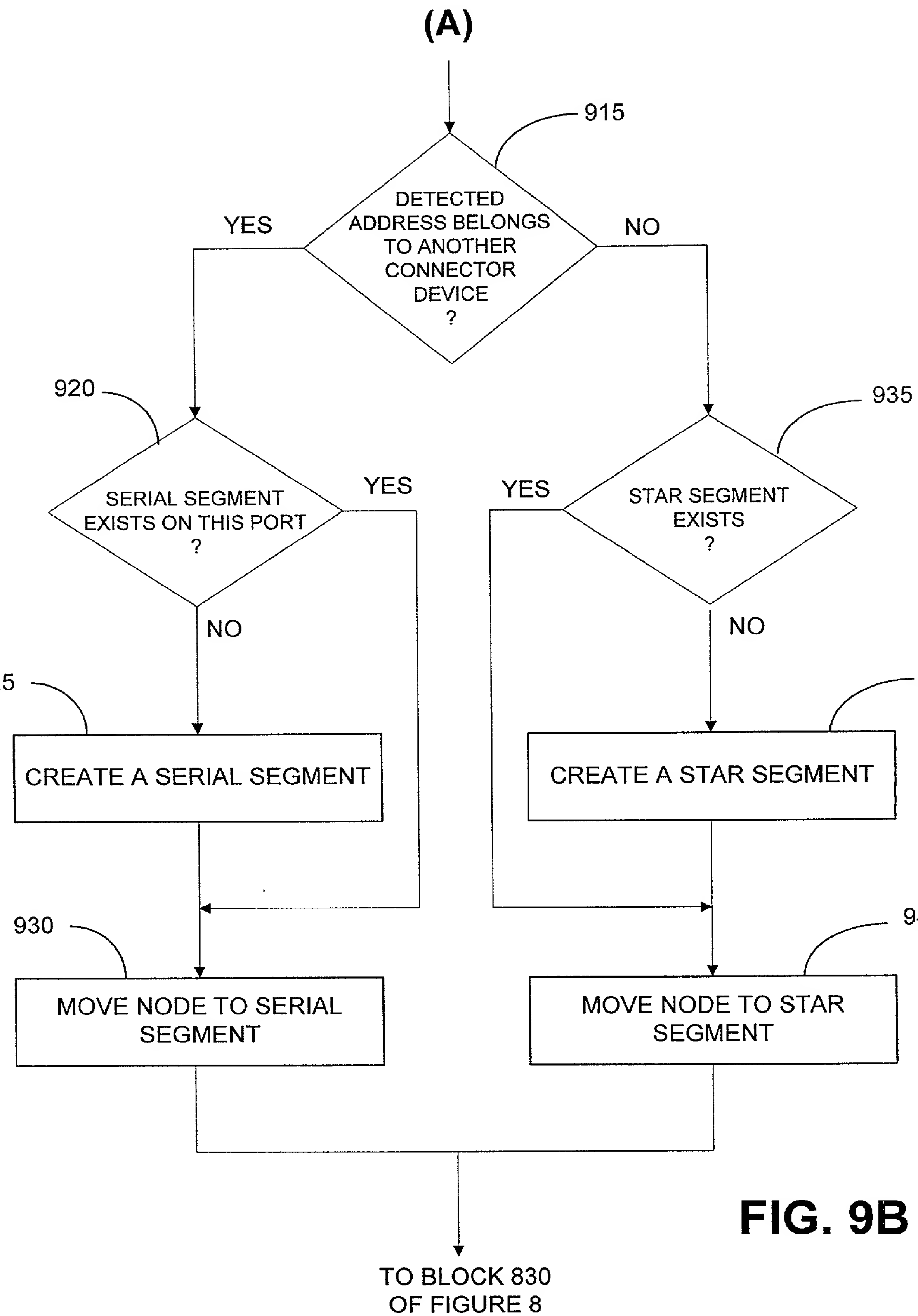
(A)
915
DETECTED ADDRESS BELONGS TO ANOTHER CONNECTOR DEVICE ?
YES
NO
920
SERIAL SEGMENT EXISTS ON THIS PORT ?
YES
NO
935
STAR SEGMENT EXISTS ?
YES
NO
925
CREATE A SERIAL SEGMENT
940
CREATE A STAR SEGMENT
930
MOVE NODE TO SERIAL SEGMENT
945
MOVE NODE TO STAR SEGMENT
TO BLOCK 830 OF FIGURE 8

FIG. 9B

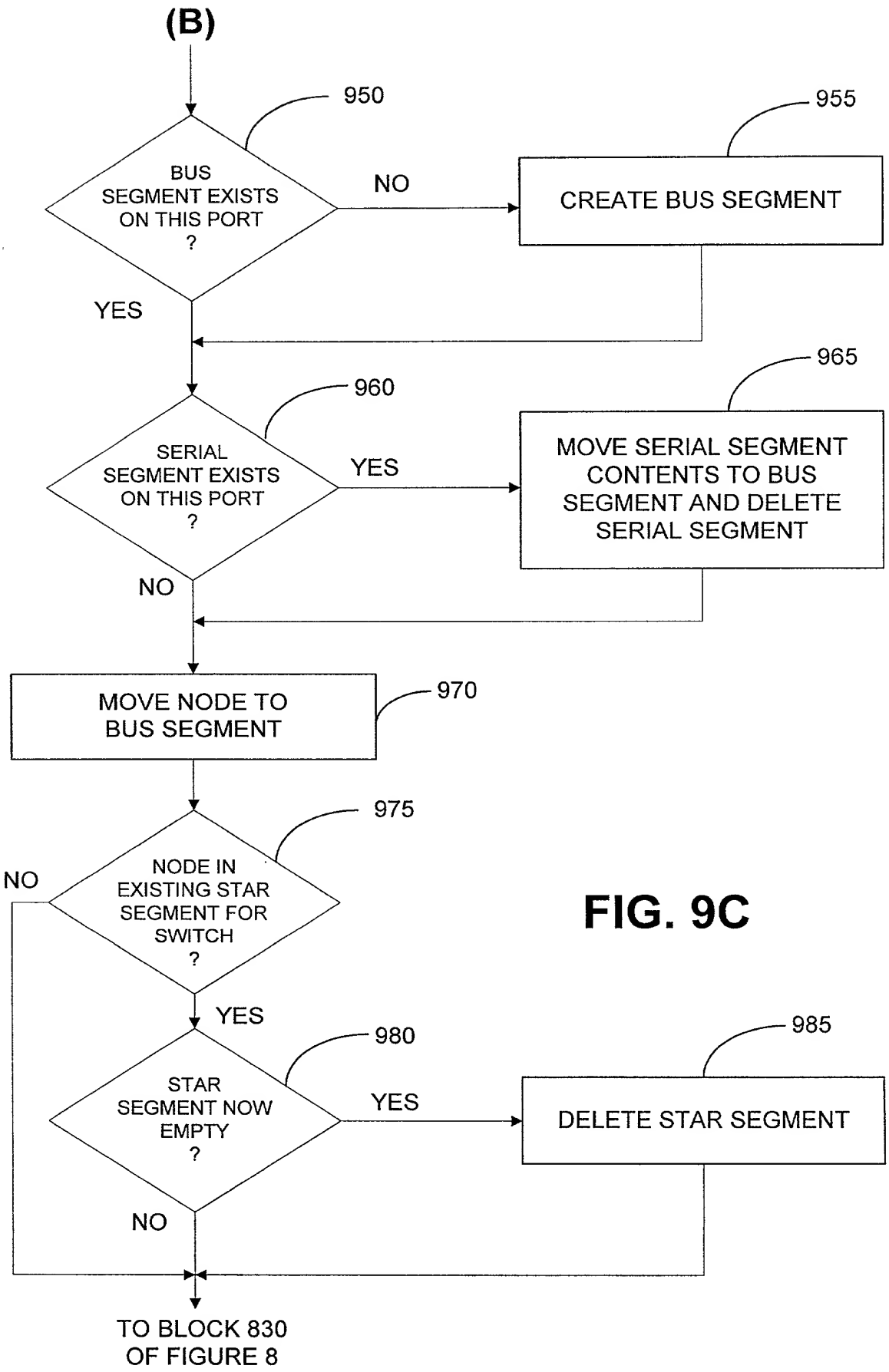
(B)
950
BUS SEGMENT EXISTS ON THIS PORT ?
NO
955
CREATE BUS SEGMENT
YES
960
SERIAL SEGMENT EXISTS ON THIS PORT ?
YES
965
MOVE SERIAL SEGMENT CONTENTS TO BUS SEGMENT AND DELETE SERIAL SEGMENT
NO
MOVE NODE TO BUS SEGMENT
970
975
NODE IN EXISTING STAR SEGMENT FOR SWITCH ?
NO
YES
980
STAR SEGMENT NOW EMPTY ?
YES
985
DELETE STAR SEGMENT
NO
TO BLOCK 830 OF FIGURE 8

FIG. 9C

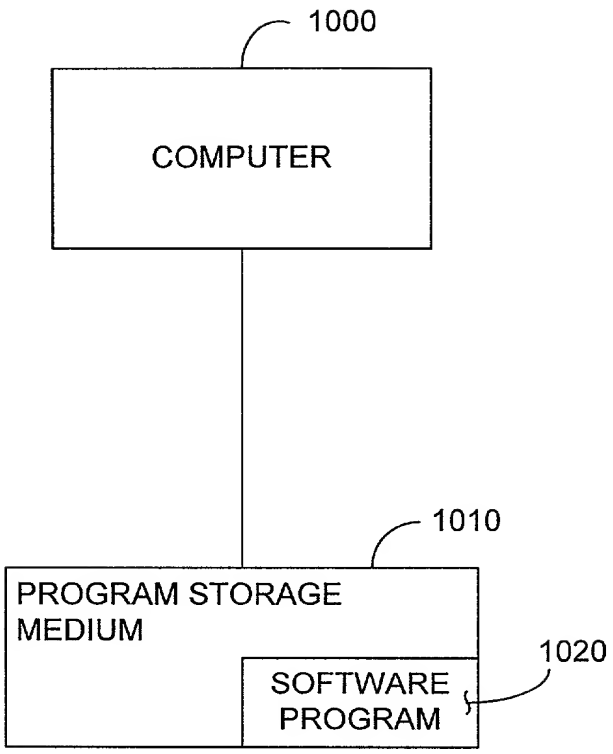
1000
COMPUTER
1010
PROGRAM STORAGE MEDIUM
1020
SOFTWARE PROGRAM

FIG. 10

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

ATTORNEY DOCKET NO. 10990871-1

As a below named inventor, I hereby declare that:

My residence/post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Method For Automatic Layout Of Switched Network Topologies

the specification of which is attached hereto unless the following box is checked:

( ) was filed on _____ as US Application Serial No. or PCT International Application Number _____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understood the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above. I acknowledge the duty to disclose all information which is material to patentability as defined in 37 CFR 1.56.

Foreign Application(s) and/or Claim of Foreign Priority

I hereby claim foreign priority benefits under Title 35, United States Code Section 119 of any foreign application(s) for patent or inventor(s) certificate listed below and have also identified below any foreign application for patent or inventor(s) certificate having a filing date before that of the application on which priority is claimed:

COUNTRY	APPLICATION NUMBER	DATE FILED	PRIORITY CLAIMED UNDER 35 U.S.C. 119
N/A			YES: ___ NO: ___
			YES. ___ NO: ___

Provisional Application

I hereby claim the benefit under Title 35, United States Code Section 119(e) of any United States provisional application(s) listed below:

APPLICATION SERIAL NUMBER	FILING DATE
N/A	

U. S. Priority Claim

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code Section 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

APPLICATION SERIAL NUMBER	FILING DATE	STATUS (patented/pending/abandoned)
N/A		

POWER OF ATTORNEY:

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

Customer Number 022879

Place Customer Number Bar Code Label here

Send Correspondence to:	Direct Telephone Calls To:
HEWLETT-PACKARD COMPANY Intellectual Property Administration P.O. Box 272400 Fort Collins, Colorado 80528-9599	Morley C Tobey, Jr. (970) 898-7239

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of Inventor: Eric A Pulsipher **Citizenship:** US

Residence: 2937 Redburn Drive Ft Collins CO 80525

Post Office Address: Same as residence

Eric A Pulsipher

Inventor's Signature

3/16/2000

Date